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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/026,886	12/27/2001	Vladimir Shlain	1078-US	1156

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EXAMINER	
TRAN, MAI T	

ART UNIT	PAPER NUMBER
2121	

DATE MAILED: 01/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/026,886	SHLAIN ET AL.	
	Examiner	Art Unit	
	Mai T. Tran	2121	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *12/27/2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is responsive to application 10/026886, filed December 27, 2001.

Claims **1-13** have been examined.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims **1-13** are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. While the claims are in the technological arts, they are not limited to practical applications in the technological arts.

The claims' focus is on "a system for automatic object classification", wherein the elements are recited in means plus function format. However, the claims fail to define a statutory specific machine.

To expedite a complete examination of the instant application, the claims rejected under 35 U.S.C. 101 as being nonstatutory above are further rejected as set forth below in anticipation of applicant amending these claims to overcome the rejection under 35 U.S.C. 101.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims **1-3, 5-10, and 12-13** are rejected under 35 U.S.C. 102(b) as being anticipated by "DCS-1: A Fuzzy Logic Expert System for Automatic Defect Classification of Semiconductor Wafer Defects" by Dr. Marc Luria et al, hereinafter Luria.

Claim 1

A system for automatic object classification comprising:

means for applying a plurality of binary rules to an object, wherein any of said binary rules is operative to classify said object to one of a pair of classes (page 2101, paragraph 3, lines 16-18); and

means for determining to which of said classes said object is classified the greatest number of times subsequent to the application of said binary rules (page 2103, paragraph 5.5, lines 2-3).

Claim 2

A system according to claim 1 and further comprising means for automatically generating said binary rules (page 2102, paragraph 5.1, lines 2-8). Automatically changing the rules as new crystals are being viewed since the comparison being made is for a new crystal and thus the classification of defects is based on wafers from that crystal.

Claim 3

A system according to claim 2 and further comprising a learning set having a plurality of said objects, wherein each of said objects in said learning set is pre-

classified as belonging to one of said classes, and wherein said means for automatically generating is operative to generate said binary rules using said learning set (page 2100, paragraph 2.2, lines 17-21).

Claim 5

A system according to claim 1 wherein:

each of said binary rules includes a first part and a second part, (Examiner interprets first part as Class A, and second part as Class B)

said means for determining is operative to calculate using said first part a degree of belonging (page 2101, paragraph 3, right column, lines 34-46) of said object to one of said classes in said class pair,

said means for determining is operative to calculate using said second part a degree of belonging (page 2101, paragraph 3, right column, lines 34-46) of said object to the other of said classes in said class pair, and

said means for applying is operative to select one of said classes in said class pairs to which said degree of belonging of said object is greater (page 2101, paragraph 3, right column, lines 51-53).

Claim 6

A system according to claim 5 wherein each of said parts comprises at least one fuzzy logic formula including at least one named predicate related to a numerical characteristic of one of said objects, and wherein said means for determining is operative to calculate said degrees of belonging using said fuzzy-logic formulae (page 2103, paragraph 5.3, lines 2-5).

Claim 7

A system according to claim 1 wherein said objects are images (page 2100, paragraph 1, lines 2 and 9).

Claim 8

A system according to claim 1 wherein said objects are semiconductor defect images and wherein said classes describe defect classes for application in semiconductor production (page 2100, title).

Claim 9

A method for automatic object classification comprising:

applying a plurality of binary rules to an object, wherein any of said binary rules is operative to classify said object to one of a pair of a plurality of classes (page 2101, paragraph 3, lines 16-18); and

determining to which of said classes said object is classified the greatest number of times subsequent to the application of said binary rules (page 2103, paragraph 5.5, lines 2-3).

Claim 10

A method according to claim 9 and further comprising:

pre-classifying a plurality of objects in a learning set as belonging to one of said classes (page 2100, paragraph 2.2, lines 17-21); and

automatically generating said binary rules (page 2102, paragraph 5.1, lines 2-8) using said learning set, wherein any of said binary rules of any of said pairs of classes is generated using any of said objects in said learning set that are pre-classified as

belonging to said pair of classes (page 2100, paragraph 2.2, lines 17-21). Automatically changing the rules as new crystals are being viewed since the comparison being made is for a new crystal and thus the classification of defects is based on wafers from that crystal.

Claim 12

A method according to claim 9 wherein:

said determining step comprises calculating a degree of belonging of said object to one of said classes in said class pair using a first part of each of said binary rules (page 2101, paragraph 3, right column, lines 34-46),

said determining step comprises calculating a degree of belonging of said object to the other of said classes in said class pair using a second part of each of said binary rules (page 2101, paragraph 3, right column, lines 34-46), and

said applying step comprises selecting one of said classes in said class pairs to which said degree of belonging of said object is greater (page 2101, paragraph 3, right column, lines 51-53).

Claim 13

A method according to claim 12 wherein said determining step comprises calculating said degrees of belonging using a fuzzy-logic formula included in each of said parts and including at least one named predicate related to a numerical characteristic of one of said objects (page 2103, paragraph 5.3, lines 2-5).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims **1-13** are rejected under 35 U.S.C. 103(a) as being unpatentable over Philip Laird et al, hereinafter Laird, and further in view of Luria.

Claim 1

Laird teaches a system for automatic object classification comprising:

means for applying a plurality of binary rules to an object, wherein any of said binary rules is operative to classify said object to one of a pair of classes; and

Laird fails to teach a system that can determine to which of said classes said object is classified the greatest number of times subsequent to the application of said binary rules. Luria teaches that after all the rules have been evaluated, the classification with the highest truth value is displayed. The purpose of this system is to provide the descriptions of defect classes more exactly. Therefore, it would have been

obvious to a person having ordinary skill in the art at the time of applicants' invention to combine Laird in view of Luria for the purpose of having a system with exact descriptions of defect classes.

Claim 2

Laird fails to teach a system with means for automatically generating said binary rules. Luria teaches a system according to claim 1 and further comprising means for automatically changing the rules as new crystals are being viewed since the comparison being made is for a new crystal and thus the classification of defects is based on wafers from that crystal.

Claim 3

Laird fails to teach a system comprising a learning set having a plurality of said objects, wherein each of said objects in said learning set is pre-classified as belonging to one of said classes, and wherein said means for automatically generating is operative to generate said binary rules using said learning set. Luria teaches that the defects on the wafer have been classified and the classification information is passed to a database system.

Claim 4

Laird teaches supervised learning classifier system.

Claim 5

Laird fails to teach a system according to claim 1 wherein:

each of said binary rules includes a first part and a second part,

said means for determining is operative to calculate using said first part a degree of belonging of said object to one of said classes in said class pair,

said means for determining is operative to calculate using said second part a degree of belonging of said object to the other of said classes in said class pair, and

said means for applying is operative to select one of said classes in said class pairs to which said degree of belonging of said object is greater. Luria teaches an expert system using fuzzy linguistic quantifiers to refer to the full range of truth values between true and false. Thus determine the degree of belonging of said object to one or the other of said classes in said class pair. The fuzzy truth value of a conjunctive is the minimum of the conjuncts and the truth value of a disjunctive is the maximum of the disjuncts.

Claim 6

Laird fails to teach a system according to claim 5 wherein each of said parts comprises at least one fuzzy logic formula including at least one named predicate related to a numerical characteristic of one of said objects, and wherein said means for determining is operative to calculate said degrees of belonging using said fuzzy-logic formulae. Luria teaches a fuzzy logic expert system in order to translate inexact characterizations of a class into a language that the computer could understand.

Claim 7

Laird teaches a supervised learning classifier system wherein said objects are images.

Claim 8

Laird fails to teach a system according to claim 1 wherein said objects are semiconductor defect images and wherein said classes describe defect classes for application in semiconductor production. Luria teaches a system for automatic defect classification of semiconductor wafer defects.

Claim 9

Laird teaches a method for automatic object classification comprising:

applying a plurality of binary rules to an object, wherein any of said binary rules is operative to classify said object to one of a pair of classes; and

Laird fails to teach a method that can determine to which of said classes said object is classified the greatest number of times subsequent to the application of said binary rules. Luria teaches that after all the rules have been evaluated, the classification with the highest truth value is displayed. This method will provide the descriptions of defect classes more exact. Therefore, it would have been obvious to a person having ordinary skill in the art at the time of applicants' invention to combine Laird in view of Luria for the purpose of having a method with exact descriptions of defect classes.

Claim 10

Laird fails to teach a method according to claim 9 and further comprising:

pre-classifying a plurality of objects in a learning set as belonging to one of said classes, and

automatically generating said binary rules using said learning set wherein any of said binary rules of any of said pairs of classes is generated using any of said objects in said learning set that are pre-classified as belonging to said pair of classes. Luria teaches that the defects on the wafer have been classified and the classification information is passed to a database system.

Claim 11

Laird teaches a method of classification using supervised learning.

Claim 12

Laird fails to teach a method according to claim 9 wherein:

said determining step comprises calculating a degree of belonging of said object to one of said classes in said class pair using a first part of each of said binary rules,

said determining step comprises calculating a degree of belonging of said object to the other of said classes in said class pair using a second part of each of said binary rules, and

said applying step comprises selecting one of said classes in said class pairs to which said degree of belonging of said object is greater. Luria teaches an expert system using fuzzy linguistic quantifiers to refer to the full range of truth values between true and false. Thus determine the degree of belonging of said object to one or the other of said classes in said class pair. The fuzzy truth value of a conjunctive is the minimum of the conjuncts and the truth value of a disjunctive is the maximum of the disjuncts.

Claim 13

Laird fails to teach a method according to claim 12 wherein said determining step comprises calculating said degrees of belonging using a fuzzy-logic formula included in each of said parts and including at least one named predicate related to a numerical characteristic of one of said objects. Luria teaches a fuzzy logic expert system in order to translate inexact characterizations of a class into a language that the computer could understand.

Conclusion

The following is prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

1. Elghazzawi, U.S. Patent No. 5,819,007
2. Hennessey et al, U.S. Patent No. 6,014,461
3. Spence et al, U.S. Patent No. 6,018,728
4. Straforini et al, U.S. Patent No. 6,092,059
5. Gordon, U.S. Patent No. 6,421,654
6. "A Neural Network Approach for classifying test structure results" by Khera et al, Proc. IEEE 1989, Int. Conference on Microelectronic Test Structures, Vol. 2, No. 1, March 1989.
7. "Adaptive Fuzzy Neural Trees" by Alois P. Heinz. In G. E. Lasker and X. Liu, editors, Advances in Intelligent Data Analysis, Proceedings of the IDA-95 Symposium, volume I, pages 70-74, Baden-Baden, Germany, Aug. 1995. The

International Institute for Advanced Studies in Systems Research and Cybernetics.

8. "Genetic Learning of Fuzzy Rule-Based Classification Systems Cooperating with Fuzzy Reasoning Methods", by Cordon et al, International Journal of Intelligent Systems, vol. 13, pages 1025-1053 (1998).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mai T. Tran whose telephone number is (571) 272-4238. The examiner can normally be reached on M-F 9:00am -- 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Anthony Knight can be reached on (571) 272-3687. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

M.T.T
Patent Examiner
Date: 1/11/2005

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